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Enterprise Risk Management Adoption: An Empirical Investigation of its Effects on Firm Performance

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Abstract

Enterprise Risk Management (ERM) is gaining relevance among financial and non-financial companies but its benefits still are uncertain. This paper aims at investigating the relationship between ERM adoption and firm performance based on a sample of 1130 non-financial companies belonging to the STOXX® index. A content analysis of individual accounts is performed to distinguish adopters, and a regression analysis explores the effect of ERM adoption on firm performance, proxied by Tobin's Q. The findings suggest that there is a statistical significant positive effect of ERM adoption on firm performance, meaning that firms are benefiting from the implementation of this process.

Keywords: Enterprise Risk Management, ERM, Firm Performance, ERM Adopters, Tobin's Q, STOXX® Index

1. Introduction

Enterprise Risk Management (ERM) is a new process for managing risks. It entails the adoption of an integrated approach to risks, a focus on all risk categories (financial, operational and strategic risk) and the definition of risk as both upside and downside volatility[1]. These characteristics oppose ERM to the Traditional Risk Management (TRM), which rather focuses on the separate mitigation of pure risks, in particular financial risks. ERM is gaining momentum among firms: according to a survey conducted by the ERM Initiative in 2014 the percentage of adopting companies increased dramatically from 8.8% in 2009 to 24.6% in 2013 in the U.S. This is mainly because firms are coping with increased complexity in risks (Beasley, Branson, and Hancock 2014), in particular after the 2007 crisis. Since 2005, Standard & Poor's has included ERM as a different rating category for the credit rating of insurance companies, and is currently enhancing this requirement to non-financial companies. Furthermore, in 2004 the Committee of Sponsoring Organizations of the Tradeway Commission (COSO) issued the Enterprise Risk Management – Integrated Framework providing guidance to adopter firms on how to apply ERM. These circumstances brought more and more firms to adopt this process, even thanks to its predicted benefits: increased efficiency and awareness of risks, improved decision making and resource allocation, reduced earnings volatility (Gates, Nicolas, and Walker 2012). All these effects combined are supposed to improve firm performance. Nonetheless, there are still some obstacles in the implementation of ERM process. Management and Boards of Directors are uncertain about the value creation opportunities arising from investment in risk management,

[1] This concept is close to the Chinese thought of risk: *weiji* (risk) is the combination of *wei* (danger) and *ji* (opportunity) (Sean Golden, 2011).

and they are feeling the presence of more pressing needs. However, before adopting ERM they want to ascertain that it adds value (Barton, Shenkir and Walker, 2010).

The increased diffusion of ERM and the reluctance of companies to adopt it before proving its benefits trigger the motivation to investigate the effects of ERM adoption on firm performance. The latter would represent the main research question of this work project. Other purposes are to characterize adopters in terms of some accounting variables and to investigate whether different sectors benefit more from ERM adoption.

This empirical exploratory research focuses on a sample of 1130 companies in the non-financial industry belonging to the STOXX® index and representing five geographical areas (Pacific, Europe, North America, Latin America and Asia). Evidence of ERM adoption has been derived from the presence of keywords in individual accounts of the companies. This research contributes to prior studies by investigating this relationship on a wider sample, checking for sector[2] and geographical differences.

The Work Project is structured as follows. Section 2 defines Enterprise Risk Management, lists its benefits and costs and explains the existing regulatory guidances. Section 3 continues with an overview of the existing literature. After drawing on the research questions in Section 4, Section 5 focuses on the methodology, the sample and data collection methods are described and the model of research is specified. Dependent and independent variables are explained conceptually and their proxies are specified. Section 6 focuses on data analysis and results (descriptive and empirical) and finally Section 7 concludes, lists limitations of the study and gives suggestions for further research.

[2] The focus of this study will be on the whole non-financial industry but on nine different *sectors*: Consumer Discretionary, Consumer Staples, Energy, Health Care, Industrials, IT, Materials, Telecommunication services and Utilities (Bloomberg).

2. What is Enterprise Risk Management?

Enterprise Risk Management is "the process by which companies identify, measure, manage and disclose all key risks to increase value to stakeholders" (Segal, 2011). Besides this broad definition, there is still not a consensus on what constitutes ERM. The extant literature and regulatory bodies[3] tend to approach the subject from different point of views, but common characteristics stand out.

Firstly, ERM takes an integrated approach to risks. Traditionally, companies have managed risks individually, in a silo-based fashion, each department focusing on their respective threats. Enterprise Risk Management, on the contrary, proposes to manage all company's risks as a portfolio. This results in increased efficiency, since the offsetting nature of some risks reduce the cost of mitigation. Moreover, by taking on a comprehensive view, it is aligned with the business strategy, leading to the achievement of strategic goals.

Secondly, it includes all risk categories. There are various definitions of risks in the ERM context. COSO defines them as "events that can have a negative impact, preventing value creation" (COSO, 2004), while events that can have positive impacts are defined as opportunities. A different definition is given by Standards Australia and New Zealand, for which risk is the "the chance that something happens that will have an impact on objectives" (Australian/New Zealand Standards, 2004). It also specifies that it can both have positive or negative impact. A similar approach is taken by Sobel and Reding (2004) who define business risk as "uncertainties that can impact the company's ability to achieve its objectives

[3] In particular, those who are concerned with ERM frameworks: Committee of Sponsoring Organizations of the Tradeway Commission's (COSO), Standards Australia and Standards New Zealand, Standard&Poor's. For more details, see section 3.1.

and can result in interdependent outcomes, both positive and negative" (Sobel and Reding 2004). This research applies the broader definition, which includes both positive and negative volatility, since it mostly reflects the ERM definition of risk as "deviation from expected" (Segal, 2011). For what concerns risk categories, the Casualty Actuarial Society provides a comprehensive list of risks that include: hazard risks, financial risks, operational risks and strategic risks (See Table B1 in Appendix B). Traditional risk management focused mainly on financial risks, defined as "unexpected changes in market variables and including market, credit and liquidity risk" (Segal 2011). Operational and strategic risk, defined respectively as "unexpected changes in elements related to operations (human resources, technology and processes)" (Segal, 2011) and to strategy formulation or execution, have been neglected by the majority of risk management programs mainly because of problems in quantification and because of the apparent superiority of financial risks. ERM, instead, identifies and measures all risks, including strategic and operational ones. Indeed, as a 2006 Conference Board survey states, the majority of directors (53%) believe that strategic risks are more threatening that financial risks, even among the financial sector[4].

Thirdly, in the ERM context, risk is defined as both upside and downside volatility. ERM adds completeness to TRM by considering not only downside risk exposure for mitigation but also upside risk exposure for exploitation. In this way, ERM contributes to decision making by linking risk and return, without sacrificing potential value-creating business opportunities. The latter, namely the possibility of balancing risk and return management, is part of what Nocco and Stulz (2006) call the "macro-benefits" of ERM. Indeed, they state

[4] Brancato et al., 2006. "The Role of U.S. Corporate Boards in Enterprise Risk Management", *The Conference Board Research Report No. R-1390-06-RR*. Available at SSRN: http://ssrn.com/abstract=941179 Accessed on 30/05/2015

that this program permits senior managers to measure and monitor the risk-return trade-off: the more risk a company (or another entity) is taking the higher return it gets. Through ERM, this trade-off is optimized. They also talk about micro benefits: an enhanced risk culture[5] that permeates the entire company and leads to a better decision-making process. For example, managers and all employees in the firm could be able to careful evaluate risk and return of a project in the same way, leading to a consensus about any action plan.

Balancing Benefits and Costs of ERM implementation

Managers and Board of Directors are, indeed, skeptic about adopting ERM because of the uncertain balance between benefits and costs of its implementation. Sim Segal (2011) comprehensively identifies the benefits of ERM, and the parties that are better off by its adoption. *Shareholders* can obtain a "higher probability of achieving returns" (Segal, 2011) since through ERM the company can more easily execute its strategic plan and give an impactful response to its major threats. The firm can become more shock resistant, reduce volatility of results and deliver stronger performance. Primary shareholders can also count on better disclosures, and consequently on enhanced information about the risks and opportunities of their investment. *Board of Directors* can be more confident regarding the understanding of risks inside the company thanks to the rigorous structure of the program, enabling their effective management. The *C-Suite* can benefit from the increased shock resistance and a more powerful tool to communicate this information to stakeholders. The latter can lead to higher stock prices, since they are able to timely respond to stock analysts' valuation about their capability of facing risks. *Management* gains from the structured

[5] Standard & Poor's defines risk culture as "the degree to which risk and risk management are important considerations in all aspects of corporate decision making" (Standard and Poor's, 2005).

decision making process embedded in ERM, thanks to which it is easier to choose among projects with different risk-return profiles. In addition, they are able to prioritize the limited resources they have and better allocate them. Lastly, *regulators* benefit from the lower systemic risk triggered by the adoption of ERM in large scale. Besides those benefits, ERM is primarily a source of competitive advantage for companies: it leads to a better shock resistance, reducing earnings volatility and increasing performance, improving market reputation thus leading to a higher company value.

The major barrier to ERM adoption is that many companies do not regard its benefits as exceeding the costs of implementation. In particular, the adoption of such a program requires some financial efforts, which companies are reluctant to take because of the presence of other priorities or insufficient resources. For example, the implementation of ERM requires setting up a risk committee or other bodies in order to oversee the process. Furthermore, change management is not easy to coordinate. It would be necessary to instruct employees to such a process and implement some training. The whole company would have to change mindset regarding risk management, and this would require some time and costs. This research aims exactly at proving the creation of value to companies deriving from ERM adoption.

3. Literature review

3.1. ERM Guidances

So far, several guidance of Enterprise Risk Management have been issued. All of them depict it as a process that embrace the whole company and through which it is possible to identify, quantify, measure and monitor risks. Non-financial companies are not mandated to adopt or follow one of them, as opposed to insurance companies for which the Standard and Poor's

rating evaluation on ERM applies. Below, a brief description of the most relevant ones (COSO, AS/NZ 4360-2009, Standard and Poor's, Turnbull Guidance) together with a small presentation of the value-based ERM framework ideated by Sim Segal (2011).

1. *COSO Enterprise Risk Management – Integrated Framework*

In 1992 COSO issued the *Internal Control – Integrated Framework*, aiming at helping companies improving their internal control system and comply with the Sarbanes-Oxley act, as a reaction to a period of several accounting and business scandals. In 2004 COSO issued the *Enterprise Risk Management – Integrated Framework*[6].

Within this framework, ERM should be supportive of an entity's objectives: Strategic ("high-level goals, aligned with and supporting its mission"), Operations ("effective and efficient use of its resources"), Reporting (reliability of reporting), Compliance ("compliance with applicable laws and regulations"). COSO also defines the components of the process: Internal environment, Objective setting, Event identification, Risk assessment, Risk response, Control activities, Information and communication, Monitoring. Objectives and components work in concert and the entire program is not thought as a "serial process" but it is rather a "multidirectional, iterative process" (COSO, 2004). This type of framework, furthermore, addresses ERM applicable to all industries and all categories of risks.

2. *Joint Australia/New Zealand 4360-2004 Standards, ISO 31000-2009*

This Australian and New Zealanders standard sets very general rules about risk management, applicable to all kinds of organizations. The framework is composed as follows:

[6] Here COSO defines ERM as "*a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives" (COSO, 2004, pp.2)*

communicate and consult internal and external stakeholders about the process, establish the context in which the process takes place, identify risks, analyse risks, evaluate risks, treat risks, monitor and review.

3. Standard and Poor's Enterprise Risk Management

As already mentioned, S&P included ERM as a different rating category in the valuation of U.S. insurance companies. This sets some criteria to evaluate the effective application of ERM by insurers. In order to evaluate the risk management of a company, S&P looks at five indicators: Risk-management culture, Risk control, Extreme events management, Risk and capital models, and Strategic risk management (Standard and Poor's, 2005). Through this evaluation it then categorizes companies on a scale rating the ERM advancement. In 2007, Standard and Poor's announced the intention to enhance the ERM evaluation to rating process of non-financial companies.

4. Combined Code and Turnbull Guidance

The Financial Reporting Council in UK firstly issued the Combined Code in 2003, in which it defined the board's role as to provide an effective framework to assess and manage risks. In 2005, it also issued a revised version of the guidance on the Combined Code, suggesting to consider a number of elements when assessing a company's risk and control processes: Risk assessment, Control environment and control activities, Information and communication, Monitoring.

5. Value-based ERM Framework

The Value Based Framework is a practical guide on how to implement ERM. Sim Segal (2011) describes it as articulated in four steps. Firstly, *risk identification* helps the company reducing the list of all the potential threats to 20-30 key risks. Then, *risk quantification* helps

identify the potential impact on the company baseline value (present value of all the cash flows to the firm), first on an individual and then on an integrated basis. Thirdly, *risk decision making* helps making decisions on how to manage risk exposure within risk tolerance and how to implement the strategic planning. Lastly, *risk messaging* consists in the communication of the process both internally and externally.

For the purpose of this research, there will not be any differentiation in terms of guidances, since they all share the same underlying principles, which is to propose a process to comprehensively identify and manage risks. The increased attention manifested through the issuance of such guidances may signal the recognition of ERM benefits by those regulators, namely the positive effect that ERM adoption may have on firm performance.

3.2. Previous empirical results

The roots of Enterprise Risk Management can be traced back to 1953, when Robert I. Mehr and Bob Hedges theorized the objective of risk management as to "maximize the productive efficiency of the enterprise" (D'Arcy, 2001). The focus was initially on only "pure risk", implying either a situation of loss or no loss (mainly hazard and financial risks). "Maximum probable loss" and "maximum possible loss" methods became the center of Traditional Risk Management, which proposed hedging activities and insurance as the main instruments for risk coverage. The possibility of exploiting natural hedges, present in Enterprise Risk Management, had still to be considered. Only recently, due to latest developments in the market and increased caution of regulators, the attention is shifting towards ERM. There are two strands of empirical research on ERM: those exploring the determinants of ERM

implementation and those investigating performance and shareholder value creation deriving from ERM (Gatzert and Martin, 2013). Some studies are twofold on both purposes.

a) Determinants of ERM implementation

Liebenberg and Hoyt (2003) are among the first to run empirical studies on ERM. Their focus is on the identification of the determinants of ERM adoption. Utilizing the appointment of a Chief Risk Officer as a proxy for the adoption of ERM, they found that more leveraged firms are more prone to appoint a Chief Risk Officer (CRO), but no significant differences regarding other variables were observed. Beasley, Clune and Hermanson (2005), instead, found that board and senior manager leadership has an impact in ERM implementation, but also size, auditor type, industry and country of domicile can explain the extent of ERM deployment. In contrast to the previous studies with US samples, Daud, Haron and Ibrahim (2011) examined the factors associated with the level of ERM implementation on Malaysian firms. Their results show that ERM is adopted in Malaysia, even if at a very early stage, and the factor influencing the level of advancement is the quality of the board of directors. A Malaysian sample was adopted also by Golshan and Rasid (2012) who found evidence only for financial leverage and the presence of a Big Four auditor.

b) Impact of ERM on shareholder value or performance

Gordon, Loeb and Tseng (2009) hypothesized that the relationship between ERM and firm performance is contingent upon some factors such as environmental uncertainty, industry competition, firm size, firm complexity and board of directors' monitoring. They found a significant effect for all the variables except for environmental uncertainty, but only for high performing firms. Grace, Leverty, Phillips and Shimpi (2010) found that ERM practices in the US insurance industry statistically significantly increase cost and revenue efficiency (a

proxy for firm performance). This approach differs from the majority of research, which uses Tobin's Q as a proxy for firm performance. Pagach and Warr (2010), whose study examines the change of financial characteristics around ERM adoption, take a different approach. They measure the change in Earnings volatility, Leverage, Return on equity (ROE), Slack, Opacity, Market-to-book ratio, R&D expense on total asset, Duration ratio, Loan loss provision and Tier 1 Risk adjusted capital ratio before and after the CRO appointment, finding no significant effect. McShane, Nair and Rustambekov (2010) found a roughly positive relationship between ERM rating and Tobin's Q, but results show that the firm value increases with a more sophisticated TRM and not with the adoption of ERM. Tobin's Q as a proxy for firm value has been adopted also by Waveru and Kisaka (2011) for a Kenyan sample and by Tahir and Razali (2011) for a Malaysian sample. While the former found a significant effect of ERM level on firm value, the latter found still positive but not significant results. Hoyt and Liebenberg (2011) applied the same approach for an US sample, finding that insurers with ERM programs are more valued than other non-adopters. Bertinetti, Cavezzali and Gardenal (2013) conducted a twofold study for financial and non-financial European companies. Firstly, they focused on the relationship between ERM and Tobin's Q, finding strong positive results, and secondly they studied the factors affecting ERM adoption, finding significant results for company opacity, size and financial slack. More recently, Ai, Chen and Zhao (2014) found evidence for a positive and significant relation between ERM and firm value in Chinese non-financial firms.

The majority of studies focusing on the value creation of ERM found positive results, some of them without statistical significance. Another common element in the literature is the choice of the dependent variable, Tobin's Q, defined as the sum of market value of equity

and book value of liabilities, divided by the book value of assets, and it is a proxy for firm value. The main contribution of this research is to include a wider sample in terms of geography, counting not only European companies but also North American, Latin American, Asian and Pacific observations, and check for sector differences in the non-financial industry. Furthermore, a most recent period is observed, namely 2005-2014. In order to build the methodology and empirical model, Bertinetti, Cavezzali and Gardenal (2013) are benchmarked because of the similarity in the purpose, which is to investigate the relation between ERM adoption and firm value and performance.

4. Methodology and Data

This is an exploratory study aiming at investigating whether a positive relation exists between ERM adoption and firm performance.

In order to characterize ERM adopters, it is necessary to identify the common elements of companies who implement this model. Therefore, a preliminary research question is:

RQ1: Which are the characteristics of ERM adopters?

The main question to be answered is:

RQ2: Does the adoption of ERM affect firm performance?

Within the ERM context, sector differences exist. This is because they have different level of volatility with respect to the market. Within the non-financial industry, Kleffner et al. (2003) found that energy firms were more likely to adopt ERM with respect to others because of their deregulated and volatile environment, which stimulated the adoption of ERM to protect the firm value. This clearly leads to the third and last question:

RQ3: Do different sectors respond differently to ERM adoption?

In order to answer the first question a descriptive analysis is carried out. Then, an empirical model will be tested in order to answer the two last questions.

4.1. Sample

This research focuses on non-financial firms. The reason behind this is that financial companies have been more heavily regulated in the area of risk management (i.e. Basel Accords and Standard & Poor's ERM enhancement) and they may adopt ERM driven by compliance motivations. Non-financial firms are increasingly applying ERM, however their adoption is voluntary. It could be then reasonable to hypothesize that they are recognizing its benefits. Listed companies have been chosen because, according to Beasley, Branson, Hancock (2014) public companies are more likely to carry on the inventory of risks at an enterprise level and state to implement a robust ERM process. Moreover, since listed companies are more likely to be audited, more detailed information is available. The initial sample includes companies from both STOXX® Global 1800 (including 600 European, 600 American and 600 Asia/Pacific region stocks) and STOXX® Latin America 200, in order to have a wide sample in geographic terms. Dropping financial firms, the initial sample includes 1561 companies from the following industries: Consumer Discretionary, Consumer Staples, Energy, Health Care, Industries, Information Technology, Materials, Telecommunication Services, and Utilities. Once companies with lacking information have been dropped, the final sample includes 1130 companies. Out of 2000 companies, 870 were excluded (See Table 1).

Table 1: Initial sample, exclusion criteria and final sample

	Initial Sample	Exclusion criteria		Final Sample
# By Country		*Financial companies*	*Lack of relevant accounting data*	
Asia	499	106	84	309
Europe	600	132	119	349
Latin America	200	51	76	73
North America	600	122	128	350
Pacific	101	28	24	49
# By Sector				
Consumer Discretionary	307	0	102	205
Consumer Staples	167	0	43	124
Energy	106	0	29	77
Financials	439	439	0	0
Healthcare	145	0	38	107
Industrials	338	0	83	255
IT	161	0	57	104
Material	177	0	35	142
Telecommunication Services	50	0	16	34
Utilities	110	0	28	82
Total	**2000**			**1130**

The period of study is 2005-2014, in order to have observation both before and after the 2007 crisis, an event that triggered awareness about the weakness of existing risk management models. In particular, it is reasonable to assume that most of the adoption has been done from 2005, because of the issuance of the most relevant frameworks (COSO and AS/NZ 4630) between 2004 and 2005.

4.2. Data Collection

All the data are collected from Bloomberg database. In particular, the ERM variable construction has been very challenging. ERM adoption is not mandatory for non-financial firms, so there is not uniformity in how firms disclose this information, if they do so. Previous research has used the CRO appointment as a proxy for ERM adoption, but this is not an

appropriate measure. Beasley, Branson and Hancock (2014), indeed, state that organizations are not likely to formally designate an individual as the CRO or equivalent executive and in their survey, only 31% of respondents designated one. In an attempt to optimally identify adopters, Bloomberg database has been used in order to perform a content analysis on companies' individual accounts, filtering them by the sentences "Enteprise Risk Management", "Enterprise Risk Management (ERM)" and "Enteprise-wide Risk Management".

4.3. Model Specification

To empirically investigate the relationship between ERM adoption and firm performance, a regression equation has been drawn. It is not possible to perform a simple OLS regression, because of the particular nature of the database, in which the same company presents data for different consequent years. The OLS model, indeed, ignores this nature and would consider each observation as correspondent to a different individual. A fixed effect panel regression model is utilized, in order to take into account the unobservable heterogeneity that exists over time and is correlated with the explanatory variables. An example could be the ability of management, a characteristic that cannot be observed but at the same time greatly impacts the implementation of management models. The appropriateness of such model is also confirmed by the Hausman test[7], which permits to reject the null hypothesis of a non-systematic difference between the coefficients. A preliminary univariate analysis was performed and the computations have been performed on Stata®.

[7] The Hausman test compares two types of estimators (in this case random effect vs. fixed effects). The null hypothesis is that the random effect is an efficient estimator of the true parameters. If it is not rejected, there should be no systematic difference between the two estimators, otherwise the assumptions on which the efficient estimator is based is not confirmed.

$$Q_{it} = \beta_0 + \beta_1 ERM_{it} + \beta_2 SIZE_{it} + \beta_3 PROFITABILITY_{it} + \beta_4 LEVERAGE_{it} + \beta_5 GROWTH_{it} + \beta_6 DIVIDENDS_{it} + \beta_7 MKTRISK_{it} + \beta_8 IASIFRS_{it} + u_{it} + \varepsilon_{it} \quad [1]$$

Following the hypothesis that ERM adoption affects firm performance, Tobin's Q is considered as a proxy for firm performance and ERM is the main independent variable. This model specification has been taken from Bertinetti, Cavezzali and Gardenal (2013). A panel data specification is used for 1130 companies during 10 years (2005-2014) for a total of 11300 observations.

4.3.1. Dependent variable

Tobin's Q is taken as a dependent variable. It is measured as:

$$Q = \frac{Total\ Market\ value\ of\ the\ firm}{Book\ value\ of\ total\ assets} \quad [2]$$

Where:

$$Market\ value\ of\ firm = Market\ value\ of\ equity + Book\ value\ of\ liabilities \quad [3]$$

Tobin's Q is a proxy for firm performance from the investors' perspective, namely shareholders. Theory suggests that when Q is lower than one, the stock is undervalued, the contrary when Q is greater than one. According to Hoyt and Liebenberg (2011), Tobin's Q is an appropriate performance measure because it reflects future expectations, differently from other accounting measures like Return on assets (ROA). Indeed, the benefits derived from ERM are not immediately realized. Lindenberg and Ross (1981) state that Tobin's Q is free from managerial manipulations, since it reflects market expectations, while Lang and

Stulz (1994) assert the superiority of Tobin's Q, by referring to the unnecessary risk adjustment or normalization when using this proxy.

4.3.2. Independent variables

Enterprise Risk Management

The aforementioned benefits of ERM adoption hypothesize a positive relation between this variable and firm performance. As suggested by Pagach and Warr (2010), ERM should decrease the probability of achieving lower tail outcomes. Previous studies found that among insurers, ERM adopters were valued 16.7% more (Hoyt and Liebenberg, 2008). Bertinetti, Cavezzali and Gardenal (2013) found similar results for both financial and non-financial firms, where ERM adopters were valued 12.2% more than non-adopters did. These results suggest that ERM should increase firm performance and therefore:

H1: *ERM is positively related to firm performance*

Firm Size

Firm size is proxied by the natural logarithm of total assets. As stated by Tongli et al. (2005), firm size must be controlled for. Indeed, superior performance can be attributed to different firm sizes. Bertinetti, Cavezzali and Gardenal (2013) find a negative significant relationship between firm size and Tobin's Q. Lang and Stulz (1994) and Allayannis and Weston (2001) also find a significantly negative relation between size and firm value. Therefore a *negative relationship between firm size and performance* can be expected.

Financial Leverage

Financial leverage is here proxied by the ratio of Total debt to Total equity. There is a mixed effect of financial leverage on firm performance. On the one hand, increases in financial

leverage have a positive impact on performance because of tax savings deriving from it. This is the base of Modigliani Miller second theorem (1963). On the other, the probability of default also increases. Based on this, *a negative relationship between leverage and performance* is hypothesized.

Profitability

Profitability can be defined as the ability of the firm to make a profit after considering any cost, and it is proxied by ROA. The latter is defined as Net income on Total assets and measures how a company is able to generate revenue from its investment of assets. It is very likely that Tobin's Q is affected by profitability: the more a company is profitable, the more it creates value, thus the more the stock value is likely to increase. Allayannis and Weston (2001) affirm that profitable firms are likely to trade at a premium. Thus, *a positive relationship between profitability and performance* is predictable.

Growth Opportunities

They are proxied by annual percentage sales growth. Following the research of Gaver (1993) and Smith and Watts (1992), it is possible to notice that high-growth firms can benefit from higher performance. In the model theorized by Bertinetti, Cavezzali and Gardenal (2013), indeed, growth opportunities, measured by sales growth, have positive but not significant impact on firm value. Therefore a possible hypothesis can be *a positive relationship between growth opportunities and performance.*

Market Risk

From the theoretical relation between risk and return, it is possible to argue that more risky firms are also more profitable. Market risk is proxied by the beta of the company,

representing the percent change in the stock price following a one per cent change in the market index price. Liebenberg and Hoyt (2011) argue that variation in Q is driven from greater volatility. Furthermore, Bertinetti, Cavezzali and Gardenal (2013) find significant and positive result on firm value. It can be then predicted that a *positive relationship exists between market risk and firm performance.*

Dividends

Dividends are proxied by a dummy variable taking value 1 when a dividend payment took place, and 0 otherwise. It is possible to assume that there is a *positive relationship between firm performance and dividends,* since dividends payout indicates that the firm has sufficient resources to make such payments. Moreover, dividend payments positively affect shareholder value creation, both according to Gordon's (1962) theoretical framework of the "Bird in Hand" and to empirical results finding positive and significant relation between dividends and firm performance (Ajanthan, 2013).

IAS/IFRS

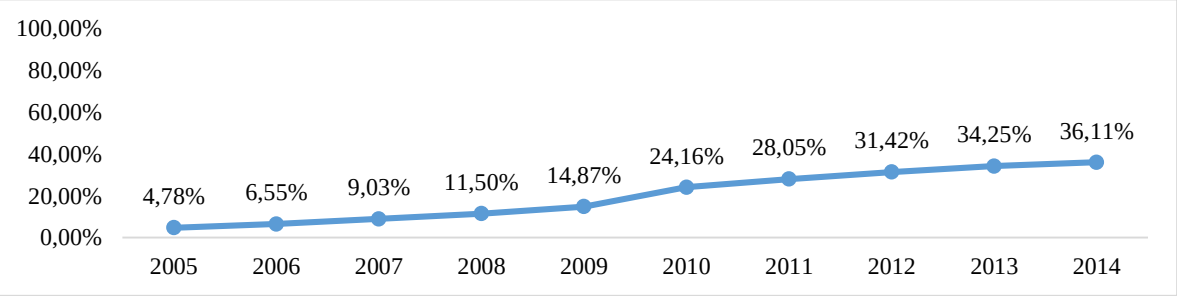
This variable is proxied by a dummy variable, taking value 1 when the company is adopting IAS/IFRS accounting standards and 0 otherwise. Firms adopting IAS/IFRS may have improved accounting quality, leading to a positive effect on its value. Daske et al. (2013) find evidence that the net effect on Tobin's Q is positive thus leading to a predicted positive relation between IAS/IFRS adoption and firm performance. An interaction effect between IAS/IFRS and ERM is then included, in order to check for the joint effect of those adoptions.

5. Data Analysis and Results

5.1. Descriptive analysis

A descriptive analysis has been carried on the whole sample as well as on subgroups by geographical area and by sector, differentiating between ERM adopters and non-adopters. This helped answering the first research question, about the identification of common characteristics of ERM adopters. Chart 1 shows the percentage of adopters in the sample. From the data it is possible to notice that the number of adopters increased steadily from 4.78% of the whole sample in 2005 to 36.11% in 2014.

Chart 1: ERM Adopters



This appears to be true also for every subgroup. Pacific and North America mostly represent early adopters, as well as Energy and Utilities industries. These trends are maintained over time, even though the number of adopters considerably increased also in the other subgroups, as shown in Charts 2 and 3.

Chart 2: ERM Adoption by Area

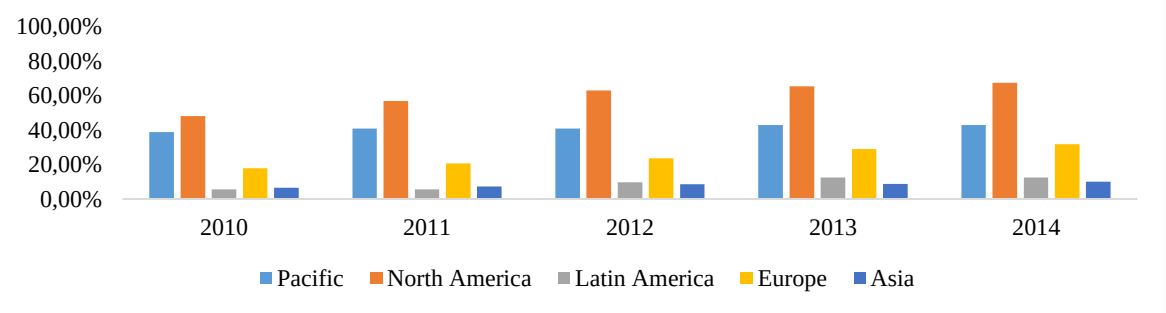


Chart 3: ERM Adoption by Sector

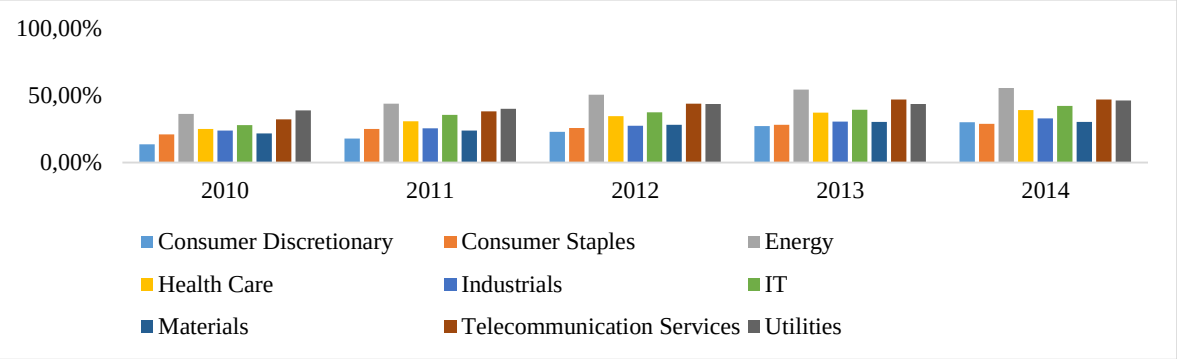


Table A4 in Appendix A shows the percentage of adopters crossed between countries and sectors. Turning to descriptive results, on average companies show a Q equal to 1.32, meaning that on average companies in the sample are overvalued. The minimum value for this variable is 0.03 and the maximum is 13.40. Size presents an average value of 8.80 log million, in a distribution which contains maximum value of 13.26 and minimum of 4. The distribution of leverage presents a mean value of 0.99, according to which the sample on average presents a nearly balanced amount of debt and equity. The sample presents a positive average for profitability (6.65%) and annual growth (0.09%), meaning that the sample contains on average profitable and growing firms. This is also true for the mean value of the beta (0.84) which shows an average positive systematic risk of the sample (See Table A1 in Appendix A).

After depicting a general picture of the sample, separate descriptive results have been drawn for adopters and non-adopters. Regarding the totality of the sample it has been possible to observe that adopters have an average Q higher than non-adopters, meaning that they are valued more than non-adopters. They are also bigger and more leveraged. Adopters present higher profitability, higher sustainable growth, lower beta and tend to pay more dividends. They are also typically IAS/IFRS non-adopters (See Table A2 in Appendix A).

These results are consistent with findings in previous studies. In particular, similar results about higher size and financial leverage of ERM adopters were found by Hoyt and Liebenberg (2003, 2011), Beasley, Clune and Hermanson (2005), Golshan and Rasid (2012), Bertinetti Cavezzali and Gardenal (2012). This research adds to the previous findings, by showing that adopters tend to pay more dividends than non-adopters, grow less, have lower betas and do not adopt IAS/IFRS standards.

A deeper analysis was carried on every subgroup (See Table B4 and B5 in Appendix B for more details). The aforementioned characteristics of adopters are somewhat confirmed in all the five areas. In each of them, ERM adopters' Q is lower than non-adopters'. In North and Latin America and Europe, adopters are less profitable though. In Asia, they are less leveraged and show a higher beta. The same is true also looking at sector subgroups. Adopters' Q is higher than non-adopters' only in four sectors, namely Consumer Staples, Consumer Discretionary, Industrials and Materials. Adopters in the Energy sector show lower leverage, as well as those in the Materials sector, which in addition present lower profitability and growth, characteristics also shared by the Telecommunication sector. In the latter, as well as in the Consumer Staples, Industrials and Information technology sectors, adopters pay fewer dividends. Adopters have lower profitability in the Industrials, Information technology and Utilities sectors. Finally, adopters in the Industrials and Telecommunication services sectors have higher betas. A possible explanation about differences in sectors is the cyclicality of each. The regression results will help going deeper into the intra-sector and –geography differences.

5.2. Regression results

Table A5 in Appendix A presents the regressions results. The univariate results show that ERM adoption has a significant negative impact on Tobin's Q, with a coefficient equal to -0.075 meaning that ERM adopters have a lower Q by 0.075 than non-adopters. The statistical significance of this coefficient can be observed through the p-value equal to zero, lower than 0.05 thus leading to the conclusion that the result is statistically significant at a five per cent significance level. Despite this results, the explanatory power of the model is very low (R^2=0.0001), thus the model is not strong enough.

Control variables must then be added. The model includes also SIZE, LEVERAGE, PROFITABILITY, GROWTH, DIVIDENDS and BETA, all of them correlated to the dependent variable as it is possible to observe from the Pearson correlation matrix (Table A3 in Appendix A). The results now support the hypothesis that ERM adoption impacts firm performance. Indeed, the coefficient turned positive, equal to 0.045 meaning that ERM adopters have an higher Q by 0.045 than non-adopters. The coefficient is significant, now at a five per cent significance level (since p-value=0.029). H1 can be then accepted. The R^2 has increased to 0.13 meaning that the explanatory power of the model has increased. Looking at the other variables, SIZE has a statistical significant negative impact on Q, while PROFITABILITY, GROWTH and DIVIDENDS have a statistically significant positive result. LEVERAGE has a positive impact while BETA a negative one, but their coefficients do not result to be significant. Including the variable IAS/IFRS, the previous results do not change. It has a negative coefficient but it is not statistically significant, thus it is not possible to draw conclusions on the relation with firm performance. When including the interaction term

between ERM and IAS/IFRS adoption, the coefficient results to be negative and non-statistically significant, while the coefficient on ERM increases.

By performing an F-test it is possible to assess that all the independent variables included in the model are jointly significant, thus the regression exists.

The results obtained are in line with previous research by Waveru and Kisaka (2011), Hoyt and Liebenberg (2011), Bertinetti, Cavezzali and Gardenal (2013), Ai, Chen, Zhao (2014) in that it finds a positive and significant relationship between ERM adoption and firm performance.

It is possible to obtain more accurate results by lagging the ERM variable by two years (Table A5 in Appendix A, column (4)). This means that the dummy variable will turn into 1 after two years from the first ERM adoption. Indeed, it is reasonable to assume that markets do not immediately react to the ERM adoption, if it appears, but it will take some time for the information to be reflected into firm's value[8]. This modification helps improving the model. The coefficient is now 0.1028 with a p-value equal to 0.00, meaning that ERM adopters have an higher Q by 0.10 than non-adopters, thus they perform better. The effects of the other variables remain the same. From now on, this model will be taken into account in order to check for country and sector differences. Also checking for robustness of the results[9], the positive and significant relationship remains.

[8] In particular it is hypothesized that one year after the first adoption is needed to set up the process, while during the second year the company can start implementing it appropriately.

[9] By typing "robust" at the end of the regression it is possible to control for heteroskedasticity, a phenomenon that often affects data for which the standard deviation of the error is not constant.

Performing the analysis for every sub group, the results hold only for some of them (See Tables B6 and B7 in Appendix B)[10]. The relationship is positive and significant only in the North American and European area. In the other seems to be positive and non-significant, except for Latin America in which it is negative and non-significant. Country differences may be in particular driven from different levels of GDP, thus a control variable for real GDP growth is also included. Nonetheless, the results do not change and the explanatory power of the model (R^2) does not improve. Besides macroeconomic variables, culture differs a lot between different countries, and consequently the approach to risk, which may be the underlying reason for such differences. Lastly, also the age of a company may be a discriminator: firms who are older may be in a stable or declining growth phase, thus needing for new ways to tackle different categories of risks. For what concerns sectors, the relationships holds only for some of them. In particular, ERM positively and significantly impact Q only in the Consumer Discretionary, Consumer Staples, Health Care, Industrials and Utilities sectors, but when coefficients' robustness is controlled for, only the Health Care sector shows significant results. The others show non-significant relationships. It is possible that uncontrolled effects have stepped in, like cyclicality. This could be driven by the sensitivity to economic cycles. Indeed, both Utilities and Energy sectors are highly sensitive to economic and political cycles. Consumer Discretionary, Industrials and Materials sectors are cyclical as well, meaning that they perform well when the economy goes well. Consumer Staples and Health Care sectors are, on the contrary, non-cyclical and characterized by stable demand. Different sectors also cope with different kind of risks; therefore, even if Enterprise

[10] The IAS/IFRS variable is no more taken into account, given its non-significant results on the whole sample.

Risk Management comprehensively manages all categories of risks, some of them may react differently to a new risk management model.

An additional and fundamental argument that can explain the differences in results is related to how companies disclose ERM adoption. Since regulators do not mandate the adoption of such a process to non-financial companies, and its implementation is voluntary, there is not a unique way through which they disclose information about ERM adoption. Therefore, those results may be driven by different levels of advancement in ERM implementation, that can be only checked through an accurate analysis of how companies disclose it.

5.3. Additional analysis

In order to internally validate the ERM variable and to further explore the inequality of ERM adoption, a disclosure analysis has been carried out. In particular, a convenience sample has been built, namely, the Telecommunication sector has been analysed because of limited dimension (34 firms). The first objective is to make sure that those companies who were identified as ERM adopters are actually implementing it. The results show that there were a very small percentage of errors. Only 8% (3 over 34) of the companies' analysed result not to implement ERM when instead were identified as ERM adopters. The reason is mainly that there are companies who mention Enterprise Risk Management in their accounts only as a future objective, without practically implementing it. Secondly, the advancement of implementation was to be explored. The results show that there is actually difference among companies when it comes to disclose ERM adoption. A scoring criterion was identified.

Table 2: Scoring criteria for ERM disclosure

0	Not mention
1	Mention an Internal control guidance

Table 2: Scoring criteria for ERM disclosure

2	Mention Enterprise Risk Management or a synonym (Enterprise-wide risk management, holistic risk management, strategic risk management)
3	Implement Enteprise Risk Management
4	Extensively implement Enterprise Risk Management, identifying the process

Results show that the majority of adopters fall in the category 1 or 2. In particular, category 1 entails the compliance with one of the guidances explained in section 3.1., thus not specifically representing a regulatory framework and leaving room for discretion. Therefore, since the majority of companies limits ERM disclosure to mentioning the adoption, it is very difficult to assess the advancement or quality of implementation. The more advanced an ERM process is, the most it can contribute to firm performance. Given the broad variability and discretion around implementation quality, it is then challenging to assess its real impact on it.

An additional analysis was carried out to check the existence of the relationship between ERM adoption and firm performance by using other proxies than Tobin's Q. Profit Margin (Net Income/Sales), Operating Margin (Earnings Before Interests and Taxes/Sales), Natural logarithm of Enterprise Value, ROA (Net Income/Total Assets), ROE (Net Income/Shareholder's Equity) and Economic Value Added/Total Assets have been assessed. Among all of them, only Profit Margin and Natural logarithm of Enterprise Value confirmed the predicted relationship; the others presented non-significant results. The reason may lie on the way the regression is built, namely, there can be other control variables that are not included and cause the relationship to be weak.

6. Conclusion

The purpose of this Work Project was to empirically investigate the impact of Enterprise Risk Management on firm performance. Enterprise Risk Management is a process for managing risk differing from traditional risk management: it takes an integrated approach, it considers all categories of risks and focuses on both upside and downside volatility. This paper started from analyzing the predicted benefits of ERM implementation, mainly better shock resistance, reduced earnings volatility and increased performance, improved market reputation and higher company value, as well as organizational costs. It then examined previous literature, focusing on studies dealing both with determinants of ERM adoption and with the relationship between ERM adoption and shareholder value creation. Regulatory guidance was scrutinized, even if none of them mandates ERM implementation. A sample of 1130 companies from the STOXX® index was taken, including North and Latin America, Europe, Pacific and Asia geographies as well as Consumer Discretionary, Consumer Staples, Energy, Health Care, Industries, Information Technology, Materials, Telecommunication Services, and Utilities sectors during the period 2005-2014. Data was collected from Bloomberg database and individual company reports were analysed to find evidence of ERM adoption. A regression equation was specified, including Tobin's Q as a dependent variable and ERM, Size, Profitability, Leverage, Growth, Dividends, Beta and IAS/IFRS as independent variables. A descriptive analysis helped characterizing ERM adopters. They resulted to have an higher Q, size, leverage, profitability, a lower growth and beta, tend to pay more dividends and are typically IAS/IFRS non-adopters. A fixed effect panel regression was then run in order to find evidence for a relationship between ERM and Q, and results suggested that such relationship exists and is statistically significant. Separate regressions

performed on every subgroup lead to the conclusion that the relationship holds only in North America and Europe, and in the Consumer Discretionary, Consumer Staples, Health Care, Industrials and Utilities sectors. A disclosure analysis helped to internally validate the ERM variable, and to assess the variability among the quality and advancement of ERM implementation.

As a result of this research, some recommendations arise for institutions related to the adoption of ERM. A better geographical distinction may be utilized when defining an ERM guidance, since cultural and macroeconomic differences are not to be neglected. Moreover, it was noticed that sectors have different shock resistance, and it would be appropriate also to discriminate in this sense. Furthermore, minimum requirements for disclosures, and standardization of them, may be imposed to ERM adopters.

The main contribution to previous results comes from the focus on non-financial companies and an analysis of a wider sample, checking both for sector and geographical differences.

This Work Project contains some limitations. Namely, the measurement of ERM adoption is not sophisticated, since companies do not have the same way of disclosing such information and different quality of implementation exists. Even if a company mentioned being an ERM adopter, it is difficult to know whether this is a formal implementation. An area for further research may be a thorough analysis of how companies are disclosing ERM implementation and how different quality and quantity of disclosure impacts firm performance. Moreover, the sample includes only listed firms, while a more extensive analysis also on unlisted firms may be appropriate. Future research can also focus on checking the relationship with another proxy for firm performance, consequently modifying the model specification.

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APPENDIX A

Table A1: Descriptive statistics (whole sample)

Variable	Obs	Mean	Std. Dev	Min	Max
Q	11300	1.32145	0.99821	0.03008	13.4039
Size	11300	8.80433	1.30706	3.99899	13.2565
Leverage	11300	0.99967	6.1787	0	340.3
Roaprofitability	11300	0.06645	0.14248	-0.5613	8.62417
Beta	11300	0.84225	43.0602	-1425.3	2346.93
Growth	11300	0.08968	0.57003	-0.92157	54.22613
Dividends	11300	0.90708	0.29033	0	1
Iasifrs	11300	0.409026	0.491675	0	1

Table A2: Descriptive statistics for ERM non-adopters/adopters

ERM=0

Variable	Obs	Mean	Std. Dev	Min	Max
Q	9032	1.316041	1.01302	0.030078	13.40387
Size	9032	8.663085	1.300337	3.998987	13.25646
Roaprofitability	9032	0.064693	0.065681	-0.56134	0.671078
Leverage	9032	0.943173	5.953121	0	340.3
Growth	9032	0.094179	0.619247	-0.92157	54.22613
Dividends	9032	0.905447	0.292612	0	1
Beta	9032	1.009193	46.79646	-1425.27	2346.934
Iasifrs	9032	0.414637	0.492687	0	1

ERM=1

Variable	Obs	Mean	Std. Dev	Min	Max
Q	2268	1.342976	0.936803	0.048447	11.07831
Size	2268	9.366811	1.175974	6.495121	13.23475
Roaprofitability	2268	0.073457	0.289722	-0.4724	8.624167
Leverage	2268	1.22466	7.002278	0	253.4499
Growth	2268	0.071779	0.302525	-0.83292	12.12761
Dividends	2268	0.91358	0.281045	0	1
Beta	2268	0.17744	22.7378	-337.108	525.7243
Iasifrs	2268	0.386684	0.487098	0	1

Table A3: Pearson Correlation Matrix

	Q	Erm	L2. Erm	Size	Leverage	Roaprofitability	Growth	Dividends	Beta	Iasifrs	Rgdpg
Q	1										
Erm											
--.	0.0411	1									
L2.	0.0294	0.7922	1								
Size	-0.3021	0.2255	0.1867	1							
Leverage	0.0117	0.0329	0.0092	0.045	1						
Roaprofitability	0.3105	0.0288	0.0313	-0.1238	-0.0198	1					
Growth	0.0597	-0.0051	-0.0131	-0.0181	-0.0017	0.0243	1				
Dividends	-0.1412	-0.0016	0.0322	0.103	-0.048	-0.0045	-0.0663	1			
Beta	-0.0139	-0.0165	-0.0043	-0.0039	-0.0187	0	-0.0038	0.0235	1		
Iasifrs	0.044	-0.044	-0.0126	-0.0168	-0.0094	0.0461	0.0229	0.1332	0.014	1	
Rgdpg	-0.1343	-0.1125	-0.0692	-0.1213	-0.0362	-0.0258	0.0554	0.1228	-0.0098	-0.2419	1

Table A4: Percentage of adopters by sector in each area

Adopters in 2014	Asia	Europe	North America	Latin America	Pacific
Consumer discretionary	6.06%	26.15%	63.49%	0.00%	14.29%
Consumer staples	3.33%	21.43%	68.57%	0.00%	50.00%
Energy	0.00%	37.50%	64.29%	33.33%	85.71%
Health Care	0.00%	38.71%	63.64%	0.00%	25.00%
Industrials	11.63%	32.97%	66.10%	23.08%	33.33%
Information technology	19.51%	28.57%	70.73%	0.00%	100.00%
Materials	4.88%	27.50%	68.75%	17.65%	41.67%
Telecommunication services	60.00%	53.33%	83.33%	0.00%	0.00%
Utilities	18.75%	45.00%	78.57%	12.50%	100.00%

Table A5: Regression results

Q	(1)	(2)	(3)	(4) [11]	(5)
Intercept	1.34	3.89	3.89	1.79	1.85
	(0.0066)***	(0.1457)***	(0.51191)***	(0.47252)***	(0.48756)***
ERM	-0.0754	0.046	0.066		
	(0.0199)***	(0.0205)**	(0.0239)***		
L2.ERM				0.1028	0.1053
				(0.0327)***	(0.0388)***
Size		-0.3048	-0.33062	-0.0731	-0.0856
		(0.0166)***	(0.01739)***	(0.0493)	(0.0537)
Roaprofitability		0.5128	0.5126	0.4493	0.4057
		(0.0430)***	(0.0430)***	(0.3996)	(0.3688)
Leverage		0.00148	0.00148	0.00333	0.00332
		(0.0009)	(0.0009)	(0.00235)	(0.00229)
Growth		0.04874	0.04858	0.04002	0.0293
		(0.0093)***	(0.0093)***	(0.0144)**	(0.0081)***
Dividends		0.07263	0.06969	0.0775	0.0443
		(0.0339)**	(0.0340)**	(0.0665)	(0.0682)
Beta		-0.00005	-0.00005	-0.00027	-0.00011
		(0.00012)	(0.00012)	(0.00085)	(0.00084)
IAS/IFRS			0.0140		-0.0040
			(0.0315)		(0.0473)
ERM*IAS/IFRS			-0.06275		-0.0987
			(0.0389)		(0.0789)
RGDPG					3.3476
					(0.4919)***
Observation	11300	11300	11300	11300	11300
R-Squared	0.0001	0.1309	0.1317	0.1449	0.0433
F-Stat	14.29	79.32	61.99	3.83	33.77
Rho	0.7167	0.6915	0.6913	0.7401	0.7544

*** p-value < 1%
** p-value < 5%
* p-value < 10%

[11] Robust coefficients

APPENDIX B

Table B1: Categories of risks as defined by Casualty Actuarial Society

Type of risk	Includes
Hazard risks	Fire and other property damage Windstorm and other natural perils Theft and other crime, personal injury Business interruption Disease and disability Liability claims
Financial Risks	Price Liquidity Credit Inflation/Purchasing power Hedging/basis risk
Operational Risks	Business operations Empowerment Information Technology Information/Business reporting
Strategic risks	Reputational damage Competition Customer wants Demographic and Social/Cultural trends Technological innovation Capital availability Regulatory and political trends

Source: Casualty Actuarial Society (2003)

Table B2: Variables definition

Variables	Definition
Q	Market value of firm / Total Assets
ERM	Dummy. ERM=1 from the first year of adoption, ERM=0 otherwise
Size	Natural logarithm of Total Assets
Roaprofitability	ROA. Net income / Total Assets
Leverage	Total Debt / Total Equity
Growth	Sales growth
Dividends	Dummy. Dividends=1 if firm paid dividends, Dividends=0 otherwise
Beta	Percent change in the stock price following a 1% change in the market index price
IAS/IFRS	Dummy. IAS/IFRS=1 if the firm adopts IAS/IFRS accounting standards, IAS/IFRS=0 otherwise

Chart B1: Areas and Sectors Breakdown

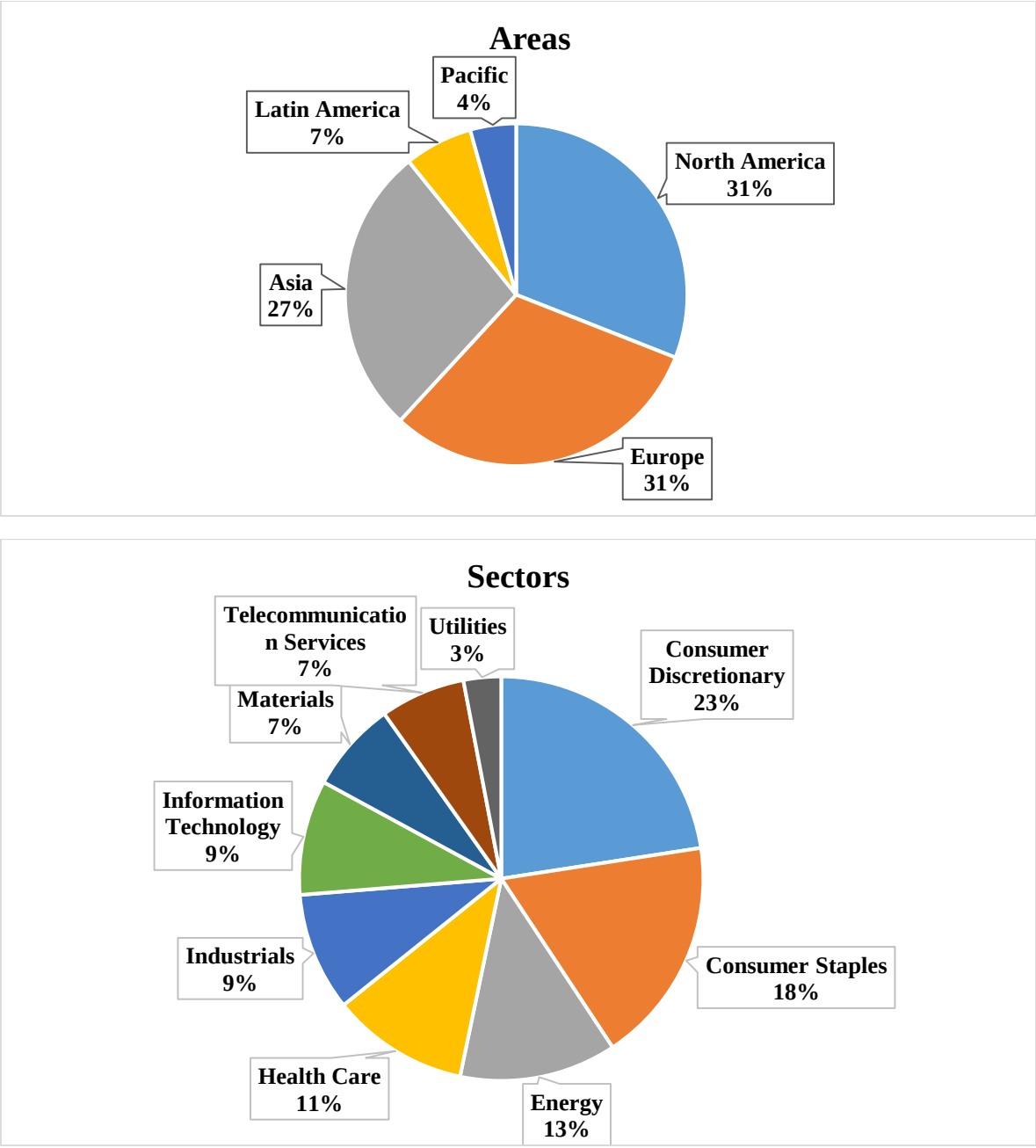

Table B3: Literature review

Author	Country	Focus	Sample	Dependent variable	Independent Variable	Findings
Liebenberg. Hoyt (2003)	US	Identify the determinants of ERM adoption	26 U.S. companies (1997-2001)	CRO appointment	Size. Leverage. Earnings volatility. Stock price volatility. Financial services. Average Market-to-Book ratio. Institutional ownership. U.K./Canadian subsidiary	Absence of systematic differences between firms that appoint a CRO and other firms. More leveraged firms are more inclined to appoint a CRO.
Beasley. Clune. Hermanson (2005)	US	Examine organizational factors associated with an entity's stage of ERM implementation.	123 US and international organizations	ERM Stage	Presence of CRO. Board members independence. the extent of CEO and CFO calls for internal audit involvement in ERM. Presence of a Big 4 auditor. Revenues. Industry. US based.	Board and senior management leadership on ERM is critical to extensive ERM deployment. and other organizational characteristics. such as size. auditor type. industry. and country of domicile also help to explain the extent of ERM implementation
Gordon. Loeb and Tseng (2009)	US	Find evidence that the relation between ERM and firm performance is contingent upon some factors.	112 US firms that disclose the implementation of their ERM activities within their 10Ks and 10Qs filed with the US Securities and Exchange Commission	Effectiveness of ERM	Environmental uncertainty. industry competition. size. firm complexity. monitoring by firm's board of directors	For high performing firms. all the contingent variables are significant except for environmental uncertainty. For non high performers. none of the variables has a significant effect on ERM
Grace. Leverty. Phillips. Shimpi (2010)	US	Examine the impact of Enterprise Risk Management on firm performance.	Life and property-insurance firm operating in US.	Cost efficiency and revenue efficiency	Firm characteristics (size. capital to asset ratio. product line mix. A.M. Best rating. part of a group of insurers. a licensed property-liability insurer. publicly traded firm. privately held stock company). ERM activities	ERM practices in insurance industry result in economically and statistically significant increases in cost and revenue efficiency.
Pagach. Warr (2010)	US	Examine the changes of financial characteristics around the ERM adoption.	106 firms listed in Compustat that appointed a Chief Risk Officer	N/A	N/A	All the changes are insignificant. No effect on firm characteristics from ERM adoption.
McShane. Nair. Rustambekov (2010)	US	Investigate the relationship between ERM and firm value	82 publicly traded insurers for which S&P released an ERM rating.	Tobin's Q	ERM rating. Size. Leverage. Systemic risk. Profitability. Cash flow volatility. Growth opportunities. Complexity	Roughly positive relationship between ERM and firm value. with a peak for ERM3 and ERM4. The results suggest that firm value increases as firms implement increasingly more sophisticated TRM but does not increase further as firms achieve ERM4
Daud. Haron. Ibrahim (2011)	Malaysia	Examine the factors associated with the level of adoption of ERM	89 board non-financial companies listed in Malaysia Bourse	Level of ERM implementation (partial or complete)	Quality of board of directors	ERM is practiced by Malaysian firms but it is still in an embronial stage. Moreover. the quality of the board of directors influences the level of ERM implementation
Eckles. Hoyt. Miller (2011)	US	Test the hypotesis that practicing ERM reduces firms' cost of reducing firm risk.	69 insurance firm that adopted ERM between 1995 and 2008	Firms' risk	ERM adoption. Size. Operation complexity. International operations. Institutional ownership. Volatility of returns. Life insurers. Best Sarbanes Oxley Act. S&P.	Firms adopting ERM experience a reduction in stock return volatility. The reduction in return volatility for ERM adopting firm is gradual and becomes stronger over time. Returns per unit of risk (ROA/return volatility) increase after ERM adoption.

Table B3: Literature review

Author	Country	Focus	Sample	Dependent variable	Independent Variable	Findings
Waveru. Kisaka (2011)	Kenya	Factors influencing the level of ERM implementation and relationship between the implementation of ERM and company's value	22 companies listed in the Nairobi Stock Exchange	Tobin's Q	ERM Level. Size. Leverage. Profitability. Dividend policy. Growth opportunities	The level of ERM implementation has a significant effect on the value of the companies that implement it.
Hoyt. Liebenberg (2011)	US	Measure the extent to which specific firms have implemented ERM programs and assess the value implications of them	117 publicly traded insurance firms (1995-2005)	Tobin's Q	ERM treatment. Size. Leverage. Sales Growth. ROA. Diversification. international diversification. Dividends. Insider share ownership. Life insurers. Beta.	Insurers with ERM programs are valued higher than other insurers. and ERM users are systematically different from non users. in terms of size. leverage. opacity. financial slack. return volatility. and institutional ownership.
Tahir. Razali (2011)	Malaysia	Estimate the relation between firm value and ERM	528 public listed Malaysian firms	Tobin's Q	ERM. Size. Leverage. International diversification. Ownership. ROA	Positive but not significant results
Golshan. Rasid (2012)	Malaysia	Investigate factors that influence ERM adoption	90 Malaysian firms	ERM Adoption	Size. Firm Complexity. Industries. Country of Domicile. Leverage. Big4. Independence of Board of Directors. Asset's Opacity. Stock Price Volatility. Institutional Ownership	Leverage and the presence of a Big Four auditor are the two influential factors of ERM adoption
Quon. Zeghal. Maingot (2012)	Canada	Examine the relationship between Enterprise Risk Management information content and firm performance.	156 non financial firms on the Standard & Poor's Toronto Stock Exchange Composite Index during 2007 and 2008	N/A	N/A	While there were differences in the observed average levels of risk assessments. they were not statistically significant. It is not possible to conclude that the assessed levels of economic or market risk exposure or consequences are related to firm performance.
Bertinetti. Cavezzali. Gardenal (2013)	Italy	Investigate the impact of ERM on the enterprise vale and discover the determinants of this adoption	200 European Companies both financial and non-financial (2002-2011)	Tobin's Q/ERM	ERM. Size. Leverage. Sales growth. ROA. Dividends. Beta/Size. Leverage. Opacity. Financial Slack. Change in EBIT. Value change	ERM adoption has a strong positive impact on company value. ERM adoption depends on the company opacity. size and financial slack.
Jing Ai. Hua Chen. Yang Zhao (2014)	China	Provide evidence for the value of ERM	1506 nonfinancial Chinese listed firms	Tobin's Q	ERM (dummy). Size. Growth. Leverage. Dividend Payments. NERI index. Controlling Shareholder. Market Index. Nature. Business Focus. Opacity. Audit Risk. Big15	ERM has a significant and positive effect of firm value

Table B4: Descriptive results by Area by adopters/non-adopters

		ERM=0					ERM=1				
Area		**Obs**	**Mean**	**St. Dev**	**Min**	**Max**	**Obs**	**Mean**	**St. Dev**	**Min**	**Max**
Asia	Q	2902	0.9155384	0.5652522	0.030078	6.863776	188	0.905485	0.4149889	0.3104447	2.707102
	Size	2902	8.59295	1.15664	5.42335	12.5906	188	8.95524	1.14145	6.74255	11.6746
	Leverage	2902	0.710841	1.03134	0	13.5184	188	0.554604	0.486331	0.002977	3.2078
	Roaprofitability	2902	0.041923	0.048316	-0.451881	0.458875	188	0.05362	0.054321	-0.101315	0.505194
	Growth	2902	0.075173	1.01916	-0.921571	54.2261	188	0.072151	0.19462	-0.791528	1.08168
	Dividends	2902	0.969331	0.172448	0	1	188	1	0	1	1
	Beta	2902	2.17555	78.0281	-1425.27	2346.93	188	3.958	38.3729	-5.4387	525.724
	Iasifrs	2902	0.094073	0.291981	0	1	188	0.367021	0.483279	0	1
Europe	Q	2896	1.375648	1.065097	0.0685898	13.40387	594	1.299481	1.04753	0.0484472	9.876987
	Size	2896	8.77033	1.42984	4.85647	12.5839	594	9.43489	1.31236	6.49512	12.7691
	Leverage	2896	0.973306	2.3071	0	53.2992	594	1.23301	4.83654	0	82.2899
	Roaprofitability	2896	0.071844	0.0712	-0.535408	0.671078	594	0.057221	0.065601	-0.349152	0.370337
	Growth	2896	0.080165	0.182442	-0.910557	2.62133	594	0.056098	0.139403	-0.517537	1.11433
	Dividends	2896	0.9375	0.242103	0	1	594	0.949495	0.219169	0	1
	Beta	2896	0.482166	20.2159	-308.366	217.366	594	0.460737	18.2952	-166.403	182.724
	Iasifrs	2896	0.944751	0.228504	0	1	594	0.897306	0.303814	0	1
Latin America	Q	692	1.302205	0.6830353	0.173535	4.590952	38	0.8575231	0.3911319	0.4376018	2.09323
	Size	692	8.2876	1.2553	5.24082	12.4323	38	8.90725	0.783841	6.73659	9.9067
	Leverage	692	0.71378	0.592348	0	3.94755	38	1.14123	1.09554	0.128462	5.21072
	Roaprofitability	692	0.070186	0.054343	-0.313116	0.27599	38	0.058928	0.036784	-0.027567	0.142796
	Growth	692	0.153479	0.248689	-0.498142	3.43132	38	0.123648	0.162216	-0.224697	0.575156
	Dividends	692	0.943642	0.230779	0	1	38	0.947368	0.226294	0	1
	Beta	692	0.896912	2.63744	-21.6656	28.6596	38	0.454758	18.2686	-89.7103	60.6877
	Iasifrs	692	0.523121	0.499826	0	1	38	0.894737	0.311012	0	1
North America	Q	2218	1.696002	1.17068	0.0344852	11.53689	1282	1.417134	0.8927227	0.1273718	6.967885
	Size	2218	8.87249	1.20926	4.31036	13.2565	1282	9.51425	1.07874	6.67745	13.2348
	Leverage	2218	1.32981	11.6432	0	340.3	1282	1.38142	8.69905	0	253.45
	Roaprofitability	2218	0.082074	0.070146	-0.561342	0.610659	1282	0.066921	0.05869	-0.472397	0.362025
	Growth	2218	0.109813	0.227919	-0.595352	3.69284	1282	0.064841	0.162014	-0.832917	1.23272

Table B4: Descriptive results by Area by adopters/non-adopters

		ERM=0					ERM=1				
Area		**Obs**	**Mean**	**St. Dev**	**Min**	**Max**	**Obs**	**Mean**	**St. Dev**	**Min**	**Max**
	Dividends	2218	0.760595	0.426816	0	1	1282	0.880655	0.32432	0	1
	Beta	2218	0.244241	20.2439	-315.453	222.829	1282	-0.442568	22.5115	-337.108	197.914
	Iasifrs	2218	0.024797	0.155541	0	1	1282	0.058502	0.234782	0	1
Pacific	Q	324	1.798944	1.597392	0.2216343	10.43783	166	1.532504	1.157242	0.2631093	11.07831
	Size	324	7.70107	1.3603	3.99899	11.6137	166	8.55589	1.03588	6.51454	11.6137
	Leverage	324	0.597921	0.804145	0	10.1413	166	0.762083	0.800466	0	7.81237
	Roaprofitability	324	0.074008	0.082344	-0.510385	0.400404	166	0.207819	1.04282	-0.252511	8.62417
	Growth	324	0.155977	0.766486	-0.567348	12.9638	166	0.169179	0.961026	-0.522335	12.1276
	Dividends	324	0.95679	0.203644	0	1	166	0.933735	0.249497	0	1
	Beta	324	0.749559	6.11691	-54.3374	36.8878	166	-0.393124	14.2305	-146.571	15.7831
	Iasifrs	324	0.984568	0.123454	0	1	166	1	0	1	1

Table B5: Descriptive Results by Sector by adopters/non-adopters

		ERM=0					ERM=1				
Sectors		**Obs**	**Mean**	**St. Dev**	**Min**	**Max**	**Obs**	**Mean**	**St. Dev**	**Min**	**Max**
Consumer Discretionary	Q	1770	1.362042	1.200311	0.034485	10.35975	280	1.454648	1.09897	0.170063	6.967885
	Size	1770	8.53661	1.26577	3.99899	12.5906	280	9.2071	1.11214	6.67745	12.7691
	Leverage	1770	0.860663	2.58301	0	43.1915	280	1.95141	15.3299	0.000409	253.45
	Roaprofitability	1770	0.068414	0.081278	-0.56134	0.567256	280	0.074841	0.064178	-0.16282	0.362025
	Growth	1770	0.098286	1.30124	-0.92157	54.2261	280	0.067574	0.110932	-0.33517	0.515883
	Dividends	1770	0.89435	0.307476	0	1	280	0.896429	0.305249	0	1
	Beta	1770	-0.10994	63.8296	-1425.27	1541.27	280	-1.42994	29.9525	-337.108	116.856
	Iasifrs	1770	0.414124	0.492709	0	1	280	0.325	0.469213	0	1
Consumer Staples	Q	1041	1.428195	0.960194	0.292687	10.22693	199	1.706425	0.90622	0.433758	5.220745
	Size	1041	8.71065	1.25599	4.31036	11.7552	199	9.32686	1.16812	6.92488	12.1033
	Leverage	1041	0.774381	1.51969	0	32.0573	199	1.78837	4.4959	0.002657	33.6747
	Roaprofitability	1041	0.067325	0.051852	-0.31312	0.510556	199	0.077015	0.057226	-0.34915	0.307634
	Growth	1041	0.079198	0.182564	-0.65781	2.44504	199	0.045304	0.13178	-0.70115	0.953824
	Dividends	1041	0.950048	0.21795	0	1	199	0.944724	0.229095	0	1

Table B5: Descriptive Results by Sector by adopters/non-adopters

		ERM=0					ERM=1				
Sectors		**Obs**	**Mean**	**St. Dev**	**Min**	**Max**	**Obs**	**Mean**	**St. Dev**	**Min**	**Max**
	Beta	1041	0.689935	10.4515	-117.589	160.507	199	-0.33197	19.7691	-244.378	56.3088
	Iasifrs	1041	0.462056	0.498798	0	1	199	0.366834	0.483156	0	1
Energy	Q	525	1.357021	1.03608	0.085471	13.40387	245	1.238701	0.650706	0.441887	3.817895
	Size	525	9.12092	1.49237	5.40954	12.5839	245	9.62609	1.07862	6.51454	12.5736
	Leverage	525	0.537483	0.561717	0	5.69895	245	0.52631	0.409427	0	3.37278
	Roaprofitability	525	0.081839	0.072024	-0.19212	0.671078	245	0.155009	0.860437	-0.14057	8.62417
	Growth	525	0.154316	0.278615	-0.77977	2.75112	245	0.099586	0.24696	-0.83292	1.11433
	Dividends	525	0.853333	0.354111	0	1	245	0.963265	0.188495	0	1
	Beta	525	-0.8128	23.0204	-308.366	217.366	245	-1.81518	15.4246	-117.101	63.9911
	Iasifrs	525	0.390476	0.488322	0	1	245	0.453061	0.498811	0	1
Health Care	Q	844	1.815036	1.316447	0.070658	11.53689	226	1.779848	1.390549	0.127372	9.876987
	Size	844	8.27895	1.33656	4.91115	11.5196	226	9.37923	1.33283	6.67515	11.909
	Leverage	844	0.563381	0.856291	0	13.5184	226	0.600258	0.480955	0	3.31868
	Roaprofitability	844	0.081623	0.061269	-0.38072	0.468414	226	0.08387	0.077911	-0.28959	0.370337
	Growth	844	0.11239	0.191445	-0.56735	2.62133	226	0.08336	0.148481	-0.21064	1.08548
	Dividends	844	0.758294	0.428371	0	1	226	0.814159	0.389842	0	1
	Beta	844	0.194483	16.7704	-194.505	151.868	226	-0.37623	22.7905	-134.137	182.724
	Iasifrs	844	0.335308	0.472378	0	1	226	0.247788	0.432686	0	1
Industrials	Q	2066	1.129954	0.810439	0.030078	7.574908	484	1.177352	0.748339	0.048447	6.49752
	Size	2066	8.60272	1.21955	5.24082	13.2565	484	9.17687	1.18159	6.74255	13.2348
	Leverage	2066	1.09964	5.13502	0	216.743	484	1.2741	7.48594	2.00E-06	161.744
	Roaprofitability	2066	0.056649	0.053838	-0.53541	0.527672	484	0.058086	0.048008	-0.15224	0.240296
	Growth	2066	0.081776	0.158494	-0.58416	1.44968	484	0.061212	0.146011	-0.37958	1.23272
	Dividends	2066	0.954017	0.209498	0	1	484	0.933884	0.248741	0	1
	Beta	2066	0.6889	22.6764	-567.035	422.194	484	2.81726	30.8531	-166.403	525.724
	Iasifrs	2066	0.455954	0.498177	0	1	484	0.39876	0.49015	0	1
Information Technology	Q	797	1.580553	1.204446	0.083181	9.035887	243	1.450148	0.989521	0.310445	7.034242
	Size	797	8.25739	1.19702	4.85647	11.7434	243	9.09413	1.2141	6.96022	12.1156
	Leverage	797	0.49028	3.11491	0	80.9635	243	0.517792	0.577691	0	3.73983

Table B5: Descriptive Results by Sector by adopters/non-adopters

		ERM=0					ERM=1				
Sectors		**Obs**	**Mean**	**St. Dev**	**Min**	**Max**	**Obs**	**Mean**	**St. Dev**	**Min**	**Max**
	Roaprofitability	797	0.074749	0.07917	-0.30176	0.610659	243	0.070132	0.077049	-0.4724	0.285417
	Growth	797	0.083127	0.199406	-0.60165	1.82441	243	0.059867	0.14	-0.58026	0.743869
	Dividends	797	0.782936	0.412505	0	1	243	0.744856	0.436842	0	1
	Beta	797	5.62021	106.631	-205.077	2346.93	243	-2.75673	18.8591	-107.911	58.655
	Iasifrs	797	0.217064	0.412505	0	1	243	0.205761	0.405091	0	1
Materials	Q	1171	1.117989	0.711628	0.135006	10.43783	249	1.420354	1.035449	0.402316	11.07831
	Size	1171	8.67236	1.10729	4.85469	11.6137	249	9.04512	1.11926	6.49512	11.6137
	Leverage	1171	1.4192	14.3388	0	340.3	249	0.852977	0.836471	0.000078	7.81237
	Roaprofitability	1171	0.055737	0.062498	-0.34577	0.582615	249	0.055372	0.070119	-0.25251	0.350126
	Growth	1171	0.086532	0.243269	-0.5271	3.69284	249	0.122852	0.790662	-0.57903	12.1276
	Dividends	1171	0.961571	0.192311	0	1	249	0.963855	0.187026	0	1
	Beta	1171	0.316746	19.4915	-315.453	170.79	249	0.279768	20.154	-207.835	74.6804
	Iasifrs	1171	0.434671	0.495926	0	1	249	0.582329	0.494169	0	1
Telecommunication Services	Q	247	1.145396	0.495937	0.249443	3.446329	93	1.12226	0.310676	0.623451	1.725185
	Size	247	9.84223	1.61518	5.47424	12.3967	93	10.2347	0.8713	8.35043	12.2
	Leverage	247	1.16291	1.48577	0.014176	16.4517	93	3.30174	11.9044	0.2992	82.2899
	Roaprofitability	247	0.063083	0.058094	-0.16001	0.455513	93	0.055823	0.041422	-0.05561	0.327703
	Growth	247	0.132903	0.856567	-0.54421	12.9638	93	0.052828	0.229966	-0.25021	1.18007
	Dividends	247	0.991903	0.089801	0	1	93	0.989247	0.103695	0	1
	Beta	247	1.14898	10.5155	-77.3758	93.7389	93	1.95233	6.1452	-19.3815	39.5716
	Iasifrs	247	0.659919	0.474698	0	1	93	0.677419	0.469997	0	1
Utilities	Q	571	0.97781	0.416802	0.173535	3.413937	249	0.85542	0.22454	0.491488	1.595745
	Size	571	9.37085	1.18534	6.1626	11.9643	249	9.94478	0.866398	7.88651	12.0558
	Leverage	571	1.43579	1.26943	0.138398	10.256	249	1.40043	0.778005	0.0829	6.72515
	Roaprofitability	571	0.041706	0.045518	-0.08911	0.28609	249	0.037156	0.037072	-0.04387	0.505194
	Growth	571	0.08578	0.209192	-0.36596	3.43132	249	0.047967	0.135398	-0.79153	0.672868
	Dividends	571	0.966725	0.179511	0	1	249	0.995984	0.063372	0	1
	Beta	571	4.02222	48.2977	-81.3429	734.931	249	1.8222	6.70361	-20.8468	38.7457
	Iasifrs	571	0.448336	0.49776	0	1	249	0.381526	0.48674	0	1

Table B6: Regression results by Area

Q	Asia	Europe	North America	Latin America	Pacific
Intercept	1.36328[12]	-0.10681	2.931854	1.695611	1.239215
	(0.6124)**	(0.7765)	(0.6860)***	(0.5401)***	-2.2759
ERM					
L2.ERM	-0.0309547	0.1007726	0.0887489	0.0393521	0.1079459
	(0.04569)	(0.06213)*	(0.0407)**	(0.0620)	(0.1745)
Size	-0.0731031	0.1309152	-0.1832609	-0.078821	-0.0783647
	(0.0708)	(0.0866)	(0.0741)***	(0.0610)	(0.2577)
Roaprofitability	3.375018	2.777162	2.483908	3.334993	0.0417662
	(0.6313)***	(0.5520)***	(0.4760)***	(0.6515)***	(0.0458)
Leverage	0.0114949	-0.0020169	0.0043281	-0.0262608	0.3726572
	(0.0122652)	(0.00233)	(0.0019)**	(0.0485)	(0.2083)*
Growth	0.02543	-0.0517462	0.1186555	-0.044705	0.105975
	(0.002)***	(0.0633)	(0.0716)*	(0.0960)	(0.0621)*
Dividends	0.0053693	0.0524168	-0.0139125	-0.0169122	0.5172324
	(0.0418)	(0.05198)	(0.1056)	(0.1199)	(0.4421)
Beta	0.0005927	0.0003258	0.0009719	0.0006058	-0.0382573
	(0.002)	(0.0006)	(0.0009)	(0.0025)	(0.0091)
IAS/IFRS					
ERM*IAS/IFRS					
RGDPG	-0.5073082	1.634795	5.973047	1.720226	3.626148
	(0.3397)	(0.2599)***	(0.5135)***	(0.6228)***	(2.5293)
Observation	2472	2792	2800	584	392
R-Squared	0.3539	0.0515	0.4733	0.2765	0.1083
F-Stat	85.66	19.4	31.8	9.6	5.7
Rho	0.637	0.7698	0.6592	0.6313	0.7942

*** p-value < 1%
** p-value < 5%
* p-value < 10%

[12] Robust coefficients

Table B7: Regression results by sectors (robust coefficients)

Q	Cons. Discr	Cons. Staples	Energy	Health Care	Industrials	IT	Materials	Telecommunication Services	Utilities
Intercept	-2.539347	-0.3383816	5.845382	3.315685	0.8656123	2.464781	5.2821	1.834126	1.988177
	(1.14863)**	(0.77006)	(0.77213)***	(1.3760)**	(0.40681)**	(1.478)*	(2.0377)**	(2.5151)	(0.4701)***
ERM									
ERM2	0.1157905	0.0748396	-0.0579846	0.360797	0.078059	0.0587974	0.091152	0.0480507	-0.0017104
	(0.1021)	(0.09004)	(0.06861)	(0.12849)***	(0.0576)	(0.07594)	(0.1442)	(0.08571)	(0.02636)
Size	0.3858713	0.1624505	-0.5285814	-0.2292068	0.0022446	-0.1412417	-0.45968	-0.0917601	-0.1296764
	(0.1303)***	(0.08643)*	(0.08269)***	(0.1589)	(0.04671)	(0.1749)	(0.2033)**	(0.2487)	(0.04767)***
Roaprofitability	3.866899	4.135074	-0.0096227	3.471831	1.927656	2.214407	1.146411	1.19364	1.12723
	(0.6269)***	(0.98665)***	(0.0317)	(1.5952)**	(0.40334)***	(0.6136)***	(1.2815)	(1.2359)	(0.9850)
Leverage	0.0079037	0.0020816	0.0389202	0.1066294	0.0022218	-0.0097902	0.003311	-0.0052265	0.0014554
	(0.00059)***	(0.0089)	(0.0650)	(0.0738)	(0.00204)	(0.00289)***	(0.00827)	(0.0013)***	(0.0126)
Growth	0.023601	0.0245752	0.0392055	0.519429	-0.0500199	0.1656497	-0.07848	0.2996549	0.0585648
	(0.00224)***	(0.0661)	(0.0542)	(0.20664)	(0.04970)	(0.13607)	(0.0475)	(0.18795)	(0.06199)
Dividends	0.1974697	-0.0098624	0.3107358	-0.202858	0.0001164	-0.1216759	-0.29172	0.075076	0.0859198
	(0.1129)*	(0.10163)	(0.1997)	(0.1130)*	(0.0632)	(0.1518)	(0.2937)	(0.0510)	(0.03705)**
Beta	0.0019697	-0.0018034	-0.0005464	0.0008001	0.0003827	0.0001508	-0.00222	-0.0027606	0.0007216
	(0.00202)	(0.00098)*	(0.0008)	(0.0017)	(0.0005)	(0.00141)	(0.00236)	(0.00421)	(0.00075)
IAS/IFRS									
ERM*IAS/IFRS									
RGDPG	1.907294	2.290099	5.085868	2.92071	3.078962	2.548491	3.410507	1.295472	1.49721
	(0.71248)***	(0.5828)***	(0.9587)***	(0.8333)***	(0.3565)***	(0.8539)***	(1.8057)*	(0.5661)**	(0.34588)***
Observation	1640	992	616	856	2040	832	1136	272	656
R-Squared	0.0102	0.2069	0.1337	0.3325	0.1316	0.2625	0.059	0.2156	0.4206
F-Stat	70.45	3.63	12.63	4.45	21.23	5.86	8.34	-	5.45
Rho	0.8226	0.7952	0.7206	0.6548	0.8207	0.6756	0.7246	0.5021	0.7281

*** p-value < 1% ; **p-value < 5%; * p-value < 10%